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Liquid crystal laser arrays

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A two-dimensional liquid crystal (LC) laser array has been demonstrated¹ using the principle of band-edge lasing in dye-doped chiral nematic liquid crystals²⁻⁴. The array is generated by photopumping the liquid crystal cell using a microlens array (fig. 1). An array of multiple monomode laser sources results, which display evidence of mutual coherence. Consequently the array can be recombined to generate a single monomode laser output (fig. 2), which in the far-field displays a Fraunhofer interference pattern similar to that obtained from a small

aperture. This opens the possibility of developing high-power organic laser microsources, and also leads to a considerable improvement in the overall efficiency of the device.

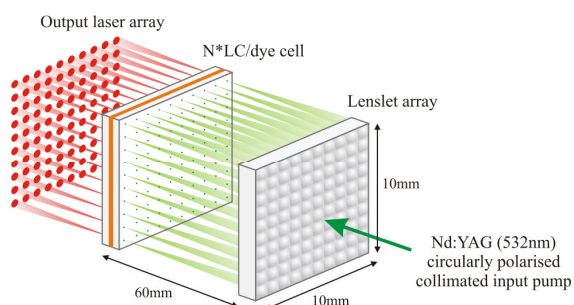


Fig. 1: A liquid crystal laser array, generated from photopumping with a microlens array.

Furthermore, the spectra of individual microsources within the array can be shown to vary with liquid crystal sample topology, where polydomain samples have been shown to generate multi-wavelength laser emission. By deliberately introducing divisions within the LC cell, each doped with differing laser dyes and LC chiral pitch lengths, it is hoped to generate red, green and blue lasing simultaneously across the array, which can then be recombined into a single white light output.

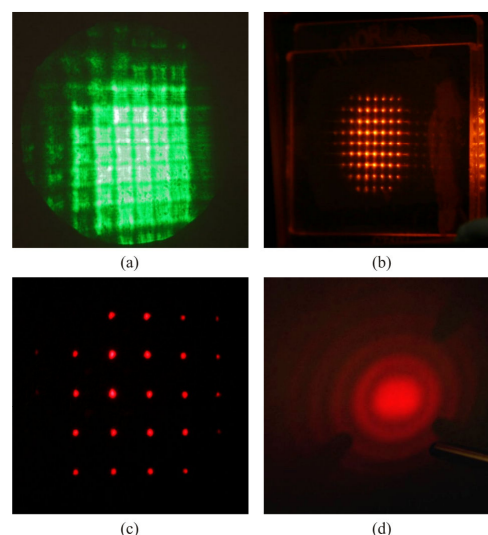


Fig. 2: (a) Illumination of the microlens array, (b) active regions within the LC cell, (c) output laser array, (d) recombined single monomode laser output.

¹ Hands, P.J.W., Morris, S.M., Wilkinson, T.D., Coles, H.J., *Optics Letters*, **2008**, doc. ID 90834 (in press).

² Kopp, V.I., Fan, B., Vithana, H. K. M., Genzack, A. Z., *Optics Letters*, **1998**, 23, 1707-1709.

³ Taheri, B., Munoz, A., Palffy-Muhoray, P., Twieg, R., *Mol. Cryst. Liq. Cryst.*, **2001**, 358, 73-82.

⁴ Ford, A.D., Morris, S.M., Coles, H.J., *Materials Today*, **2006**, 9, 36-42.